

REMARKS

I. AMENDMENT OF THE SPECIFICATION

The amendments to the specification are fully supported by the specification, drawings and claims as originally filed. No new matter is added, and entry of the amendments is respectfully requested.

The specification is being amended at page 7 to insert “isotropic” before “coefficient of thermal expansion”. This change is being made to achieve correspondence between terms used in the claims as amended and the specification, and is necessarily supported by information disclosed in the specification and claims as originally filed.

The Court of Customs and Patent Appeals stated in *In re Smythe*, 480 F.2d 1376, (CCPA 1973) that:

By disclosing in a patent application a device that inherently performs a function, operates according to a theory, or has an advantage, a patent applicant necessarily discloses that function, theory or advantage even though he says nothing concerning it. The application may later be amended to recite the function, theory or advantage without introducing prohibited new matter.

In particular, Applicants submit that information disclosed in the specification includes the information that: (i) the substrate is supported around its periphery by a portion of the upwardly inclined surface 48 of the wafer carrier (page 6, lines 8 to 10); (ii) the wafer carrier is subject to thermal expansion during processing (page 7, lines 6 to 8); and (iii) it is an object of the invention to provide a wafer carrier that prevents deposition on the backside of a substrate (page 3, lines 7 to 8). Thus, Applicants submit that the disclosed information necessarily supports the amendment to the specification that the wafer carrier comprises an isotropic coefficient of thermal expansion, since anisotropic expansion of the wafer carrier would necessarily result in the peripheral edge becoming separated from the upwardly inclined surface 48 at some point resulting in deposition on the backside of a substrate.

II. STATUS OF THE CLAIMS

Claims 1-6, 8-12, 24 to 28 are pending in the application, of which claim has been amended and claims 24 to 28 have been added.

Applicants submit that the subject matter of the amendment to claim 1 and added claims 24 to 28 is fully supported by information disclosed in the figures, specification and claims as originally filed for the reasons give above in connection with amendment to the specification.

Applicants further submit that the amendments to claim 1 and the added claims do not present new issues. In particular, Applicants submit that the limitation that the wafer carrier is comprised of a material having a coefficient of thermal expansion that enables it to maintain contact substantially entirely around the peripheral edge of the substrate during processing at elevated temperatures falls within the scope of claims 1, 13 and 7, as originally filed. Claims 1 and 13 include the limitation that the substrate is supported by said wafer carrier only around the periphery or peripheral edge of the substrate. Claim 7 provides a specific range for a coefficient of thermal expansion for the wafer carrier, thereby implying that the wafer carrier expands and contracts during heating and cooling.

Claims 26 to 28 provide that the substrate has a coefficient of thermal expansion in the same range as the wafer carrier; that the coefficient of thermal expansion of the substrate is in equal to that of the wafer carrier; and that the coefficient of thermal expansion of the substrate is isotropic. Applicants submit these claims do not raise new issues but rather are supported by, for example, the limitations of claim 1 as presented in response to the preceding office action, which provided inter alia that the substrate is comprised of a material having a coefficient of thermal expansion in the range of 2.6×10^{-6} to $5 \times 10^{-6} / ^\circ\text{C}$.

Rejections under 35 U.S.C. § 102(e)

Claims 1, 2, 5 and 8 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,891,251 to MacLeish *et al.*, hereinafter MACLEISH.

Applicants' respectfully disagree and submit that as amended claim 1 is patentably novel over MACLEISH.

An anticipation rejection requires that a single reference expressly or inherently disclose each and every element of a claim. *In re Paulsen*, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994); MPEP § 2131

(citing *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989)). Additionally, the reference must enable and describe the claimed invention “sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention.” 31 USPQ2d at 1673. To be enabling, the reference must teach the skilled artisan how to make and use the full scope of the claimed invention without undue experimentation. See *Genentech Inc. v. Novo Nordisk A/S*, 42 USPQ2d 1001, 1004 (Fed. Cir. 1997).

As amended claim 1 includes the limitation that the “wafer carrier is comprised of a material having a coefficient of thermal expansion that enables the upwardly inclined surface to maintain contact substantially entirely around the peripheral edge of the substrate during processing at elevated temperatures.” This limitation requires that the wafer carrier be made of a material that: (i) expands substantially uniformly along all axis and in all directions, i.e., have an isotropic coefficient of thermal expansion; and (ii) have a coefficient of thermal expansion substantially equal to that of the substrate or wafer.

In contrast, the graphite used in the susceptor disclosed in MACLEISH does not have an isotropic coefficient of thermal expansion, and therefore would not expand uniformly along all axis and in all directions. Thus, the graphite susceptor disclosed in MACLEISH would permit backside deposition. Accordingly, Applicants submit that MACLEISH does not anticipate the claimed invention, and respectfully request the claim 1 and claims dependent therefrom be allowed.

Applicants also submit that for reasons similar to those given above added claims 24 to 28 are also novel over the cited references. Claim 24, which is dependent on claim 1, and independent claim 25 include the express limitation that the wafer carrier is made of “a material having an *isotropic* coefficient of thermal expansion in the range of 2.6×10^{-6} to $5 \times 10^{-6} / ^\circ \text{C}$.” Claim 26, which is dependent on added claim 25, adds the limitation that the substrate “comprises a material having a coefficient of thermal expansion in the range of 2.6×10^{-6} to $5 \times 10^{-6} / ^\circ \text{C}$ ”, which is the same range as the wafer carrier. Claim 27 adds the limitation that the substrate is made of “a material having a coefficient of thermal expansion substantially equal to that of the wafer carrier”, and claim 28 adds the limitation that the substrate has an isotropic coefficient of thermal expansion.

Applicants submit that the limitations of these added claims are not disclosed in MACLEISH, and therefore MACLEISH does not anticipate the invention of the added claims. Accordingly, the Applicants respectfully requests that added claims 24 to 28 be allowed.

Rejections under 35 U.S.C. § 103(a)

The Examiner also rejected claims 3, 4, 6 and 10-12 stand under 35 U.S.C. § 103(a) as being obvious over MACLEISH, and claims 3 and 9 as being obvious over MACLEISH in view of U.S. Patent No. 5,837,058 to Chen *et al.*, hereinafter CHEN.

Applicants' respectfully disagree.

To establish a prima facie case of obviousness it must be established that (1) there is some suggestion or motivation in the prior art to combine the references; (2) there must be a reasonable expectation of success; (3) the references when combined must teach or suggest all the claim limitations. M.P.E.P. §2143, p. 2100-111.

MACLEISH is directed to a susceptor 50 made from graphite to absorb RF radiation from the induction coils to heat a wafer 52 or substrate. (Col. 5, lines 59-63) The graphite susceptor in MACLEISH does not have a coefficient of thermal expansion that enables it to maintain contact substantially entirely around the peripheral edge of the substrate during processing at elevated temperatures. That is, MACLEISH does not teach or suggest a susceptor having an isotropic coefficient of thermal expansion, and a coefficient of thermal expansion substantially equal to that of the substrate. Thus, expansion and contraction of the susceptor in MACLEISH causes relative movement between the substrate and susceptor during heating and cooling resulting in deposition on the backside of the substrate.

CHEN discloses a graphite susceptor with an oxidation resistant aluminum nitride coating that closely matches the thermal coefficient of the graphite in order to prevent cracking of the coating. Chen does not teach or suggest a susceptor having an isotropic coefficient of thermal expansion, or a coefficient of thermal expansion substantially equal to that of the substrate.

In contrast, the present invention, as claimed in independent claim 1 as amended, teaches that the wafer carrier is comprised of "a material having a coefficient of thermal expansion that enables the upwardly inclined surface to maintain contact substantially entirely around the peripheral edge of the substrate during processing at elevated temperatures." This limitation requires that the wafer carrier be made of a material that: (i) expands substantially uniformly along all axis and in all directions, i.e., have an isotropic coefficient of thermal expansion; and (ii) have a coefficient of thermal expansion substantially equal to that of the substrate or wafer. Thus, Applicants submit that

claimed invention is non-obvious over the cited references, since the cited references alone or in combination do not teach or suggest all the claim limitations.

Additionally, Applicants respectfully submit that the present invention seeks to prevent backside deposition and maximize heat transfer between the wafer carrier and the substrate by maintaining contact between the substrate and the upwardly inclined surface of the wafer carrier “substantially entirely around the peripheral edge of the substrate”, as claimed in amended claim 1. In contrast, MACLEISH teaches minimizing the number of points in contact with the substrate to minimize conductive heat transfer between the susceptor and the substrate. In practice this is typically done by supporting the substrate at three equidistant points, either on the perimeter or beneath the substrate. Applicants submit that it is rather implausible to conclude that MACLEISH teaches minimizing the number of contact points by maximizing contact at the edge of the substrate. Accordingly, Applicants respectfully submit that MACLEISH teaches away from the present invention by teaching minimizing the number of points in contact with the substrate to minimize conductive heat transfer between the susceptor and the substrate.

Accordingly, Applicants submit that the cited references alone or in combination do not teach or suggest all limitations of the claimed invention, and respectfully request that the rejection be withdrawn and claim 1 and claims dependent therefrom be allowed.

Applicants also submit that for reasons similar to those given above added claims 24 to 28 are neither anticipated or obvious in light of the cited references alone or in combination. Accordingly, the Applicants respectfully requests that added claims 24 to 28 be allowed.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned “Version with markings to show changes made”.

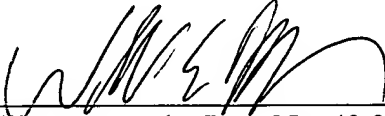
CONCLUSION

For the foregoing reasons, Applicants respectfully submit that the pending claims are novel and non-obvious over the cited references singularly or in combination. An early notice of allowance of all claims is respectfully requested.

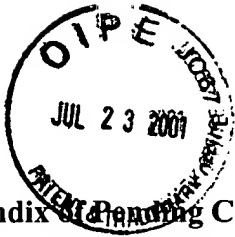
If any matters can be handled by telephone, Applicants requests that the Examiner telephone Applicants' attorney at the number below.

The Commissioner is authorized to charge any additional fees, including fees for extension of time, to Deposit Account No. 06-1300 (Order No. A-64873-1/MSS/WEN).

Respectfully submitted,

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Appendix of Pending Claims
Amend. Filed: 07/18/01
Serial No.: 09/457,929

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The paragraph beginning at page 7, line 3, has been amended as follows:

To maintain the desirable line or point contact with the peripheral edge of the wafer and to provide secure support of the wafer, the thermal expansion of the wafer carrier is considered. Preferably, little thermal expansion occurs during the process so that the desired angle of the incline is preserved. Specifically, the wafer carrier is comprised of a material having [a] an isotropic coefficient of thermal expansion in the range of $2.6 \times 10^{-6}/^{\circ}\text{C}$ to $5 \times 10^{-6}/^{\circ}\text{C}$, with the lower values preferred. Materials with suitable coefficients of thermal expansion include silicon and silicon carbide.

IN THE CLAIMS:

Claim 1 has been amended as follows:

1. (Amended) A wafer carrier for supporting a substrate, comprising:

a circular plate having a flat edge region extending around the circumference of said plate;
and

a circular recessed center region having a recessed bottom surface and including an upwardly inclined surface around the periphery of said recessed bottom surface,

wherein the substrate is supported by a portion of the upwardly inclined surface and is spaced apart from said recessed bottom surface such that the substrate is supported by said wafer carrier only around [the entire periphery] a peripheral edge of the substrate, and

wherein said [substrate] wafer carrier is comprised of a material having a coefficient of thermal expansion [in the range of 2.6×10^{-6} to $5 \times 10^{-6}/^{\circ}\text{C}$] that enables the upwardly inclined surface to maintain contact substantially entirely around the peripheral edge of the substrate during processing at elevated temperatures,

whereby deposition on a backside of the substrate is substantially prevented.

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Appendix of Pending Claims

Amend. Filed: 07/18/01

Serial No.: 09/457,929

Claims 24 to 28 have been added as follows:

24. (Added) The wafer carrier of Claim 1 wherein said material of the wafer carrier comprises an isotropic coefficient of thermal expansion in the range of 2.6×10^{-6} to $5 \times 10^{-6}/^{\circ}\text{C}$.

25. (Added) A wafer carrier for supporting a substrate comprising:

a circular plate having a flat edge region extending around the circumference of said plate;
and

a circular recessed center region having a recessed bottom surface and including an upwardly inclined surface around the periphery of said recessed bottom surface,

wherein the substrate is supported by a portion of the upwardly inclined surface and is spaced apart from said recessed bottom surface such that the substrate is supported by said wafer carrier only around a peripheral edge of the substrate, and

wherein said wafer carrier comprises a material having an isotropic coefficient of thermal expansion in the range of 2.6×10^{-6} to $5 \times 10^{-6}/^{\circ}\text{C}$.

26. (Added) The wafer carrier of Claim 25 wherein said substrate comprises a material having a coefficient of thermal expansion in the range of 2.6×10^{-6} to $5 \times 10^{-6}/^{\circ}\text{C}$.

27. (Added) The wafer carrier of Claim 25 wherein said material of the substrate comprises a material having a coefficient of thermal expansion substantially equal to that of the wafer carrier.

28. (Added) The wafer carrier of Claim 25 wherein said material of the substrate comprises an isotropic coefficient of thermal expansion.